THE ECOLOGY OF SUGARLOAF BUSH, CASS

I. FOREST HISTORY AND VASCULAR PLANT FLORA

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ABSTRACT

A brief history of the discrete *Nothofagus solandri* stand, Sugarloaf Bush, Cass, is inferred from various kinds of evidence. The vascular plant flora of the forest is listed.

KEYWORDS: *Nothofagus solandri*, forest history, radiocarbon dates, flora.

INTRODUCTION

Sugarloaf Bush is a small stand of forest of about 45 ha, at Cass, occupying a steep-sided valley between Cass Hill to the northwest and Foweraker Spur, a ridge descending from Mt Sugarloaf, to the east and south-east (Fig. 1). The valley is fault-guided; its main axis lies southwest-northeast and there is a non-forested saddle at its head, at about 870 m a.s.l., giving access to the main Waimakariri Valley. Slopes to the northwest rise to 1070 m and those to the east to the same altitude. All of Sugarloaf Bush is below 915 m, however, and the lowest part of the Bush, where the small stream leaves the forest, is at about 700 m a.s.l. Within the main valley there are several minor tributary valleys with intervening ridges.

The rock type in Sugarloaf Bush Valley is sandstone of the Torlesse Group. There are some rock outcrops, but mostly the slopes (often lying at steep angles, up to 30° or more) are mantled by deposits of shattered rock debris, usually mingled, near the surface, with finer material of silt size, probably of loessic origin. These slope deposits form the substrate for the trees of the forest and are of very variable composition, with respect to the differing proportions of coarse particles (sand, pebbles and cobbles) and of silt-sized particles.

The trees of Sugarloaf Bush are almost all *Nothofagus solandri* var. *cliffortioides* (hereafter referred to as *N. solandri*). A few mature specimens of hybrids of this species with *N. fusca*, identified from fallen leaves, appear to be present and juveniles are present, also. The stand of forest was chosen to be a long-term study area for the biology of *N. solandri*, as a teaching aid for undergraduate classes in ecology in the Botany Department.

The area is accessible from the Cass Field Station, yet relatively remote so that, it was hoped, experiments would not be interfered with. Its size is sufficient for there to be a reasonably extensive "forest" environment and to enable experiments to be laid out. Its location ensures that there are contrasting habitat conditions, particularly those created by the mainly north-west and mainly south-east aspects on either side of the main valley.

In this paper the history of the Bush as a distinct entity is briefly described and the vascular plants found within the forest margin are listed.

HISTORY OF SUGARLOAF BUSH

The history of the Bush, and of other small forest stands near Cass, is inferred from evidence which includes observations of vegetation changes from old photographs and other historic sources, measurements of ages of some trees, observations of tree growth forms, observations of evidence for former forest distribution, pollen analyses and radiocarbon dates for particular events, including the destruction of forest in the Cass district by fire. *Nothofagus* forest expanded to become dominant in the Cass district about 6600 years ago (radiocarbon date N.Z. - 5288; 6620 ± 100 yr B.P., Kettlehole Bog site, a date for the transition from mixed podocarp forest to beech forest in the region). The large alluvial fans below Sugarloaf Bush were clad in *N. solandri* forest containing some *Phyllocladus alpinus* about 3250 years ago and subsequently (radiocarbon date N.Z. - 5294; 3250 ± 80 yr B.P., Remus Swamp site, a date for the bottom of a sediment column 4.5 m thick, which contains *Nothofagus* leaves and *Phyllocladus* cladodes). At this time and probably up to about 500 years ago there would have been continuous forest cover over Cass Hill, Foweraker Spur and Mt Sugarloaf, as well as in Sugarloaf Bush Valley and the fans below it.

About 500 years ago the forest of the Cass basin was grossly disturbed by fire and probably Sugarloaf Bush and similar small forest pockets originated then, either as small patches which escaped destruction, or as stands which sprang up in the ashes of the fire, or both. The general evidence for fire and widespread forest destruction in the region is outlined by Burrows (1960) and Molloy (1977) but the close dating of forest fire, about 500 years ago, comes from a charred *Dracophyllum* stump in peat, recovered with the help of the Botany 304 class of 1980 (radiocarbon date N.Z. - 5297; 531 ± 57 yr B.P., Horrible Bog site). These and other

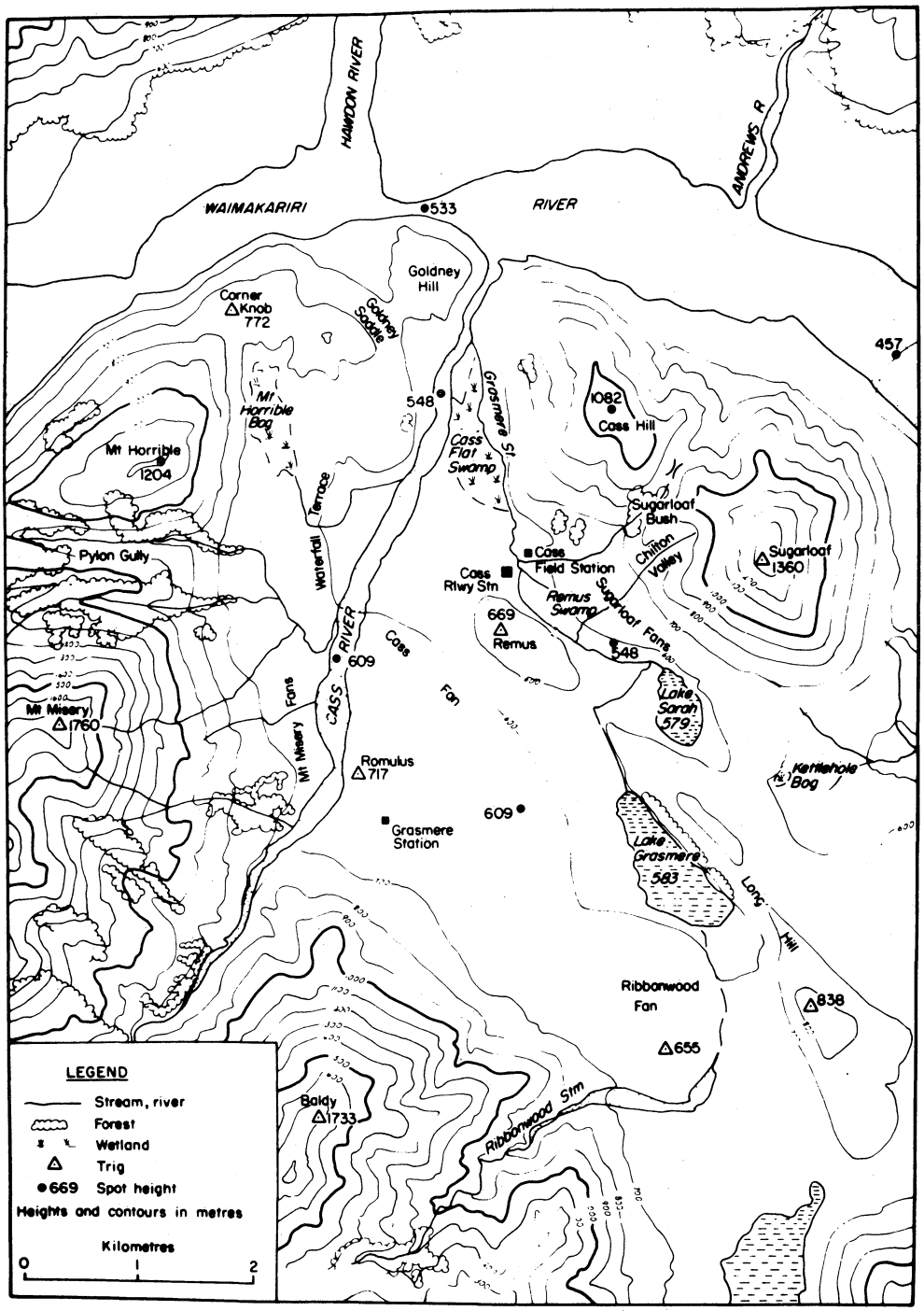

Fig. 1. The Cass region, showing the location of Sugarloaf Bush and other places mentioned in the text.

radiocarbon dates, and their significance, are to be described more fully elsewhere (Burrows 1982, in preparation). Molloy (1977) described other radiocarbon dates from the region. Buried charcoal was found in soil pits on the saddle at the head of Sugarloaf Valley, but it has not been dated.

Since the forest fire of 500 years ago, there could have been as few as about two or three full generations of mature trees in Sugarloaf Bush. The greatest age of trees obtained so far from the small forest stands in the Cass Basin is 170 years, although elsewhere, near Cass, *N. solandri* is known to live to 300 years or more (Wardle 1970, Burrows 1977, D.A.N., unpublished data).

When the European sheep farmers came to Cass they burned large areas of the vegetation as a farm management practice (McLeod & McLeod 1977). By 1915, as is evident from photographs taken by C.E. Foweraker, such fires had cleared scrub from Cass Hill, Foweraker Spur and Mt Sugarloaf and possibly had trimmed back the margin of Sugarloaf Bush. In these photographs, the forest has a very sharp boundary with fescue tussock grassland. Since then, apparently, no fire has affected the Bush and scrub communities have developed on the slopes around the Bush. There has also been advance outward of the forest margin by development of young *N. solandri* stands. These form a narrow band round most of the perimeter of the Bush. The density and relatively small stem diameter of trees in this band, and the small tree canopies, contrast with the more widely-spaced old trees of large stem diameter at the old forest margin of *circa* 1915. These old trees have numerous spreading branches and wide crowns because they developed in the absence of competition, unlike the straight, taller trees of the forest interior. Some are senile now and some have either lost major branches by wind-break, or major branches or whole trees have died, recently. Within the forest regeneration of *Nothofagus solandri* is widespread and vigorous.

Within Sugarloaf Bush there has been considerable disturbance of various kinds in the last few decades. In 1957, during an exceptional rainstorm Sugarloaf Bush stream and its tributaries (normally quiet, clear and small) flooded severely and scoured their banks and beds. Some alluvium was deposited in reaches on the narrow valley floor and beyond Sugarloaf Bush. Some minor slips stripped the soil mantle from steep slopes near the stream. Since then other large storms have caused some bed disturbance but at present the stream is relatively stable. In the last three years numerous mature trees have been felled by wind-storms, lifting much soil on their root masses and causing openings in the forest. Such events must have occurred at intervals in the more distant past, judging by the size distribution of patches of young trees in the forest (cf. Burrows 1977). Small-scale disturbance results from pig-rooting in places in the valley and from sheep which shelter in the forest at its southwestern end and browse the young trees there. A future project will involve mapping the location of all trees and monitoring change in some reasonably extensive areas within the forest.

VASCULAR PLANT SPECIES IN SUGARLOAF BUSH

The list (Table 1) comprises the species found within the perimeter of the main stand of forest. Many are, characteristically, found in closed forest habitats, some often occur either in forest or in other kinds of vegetated site and some are most often found in open habitats with no or only sparse vegetation cover. The recent disturbances noted above favour this latter group. A few species are present in seepage areas within the forest, sometimes forming small glades. The contrasting sides of the valley are differentiated in the list. The list is based on specimens collected by D.A.N., C.J.B. and A.J. and L.N. Conner and retained in the Herbarium of the Botany Department. It may not be complete. Nomenclature is after Allan (1961), Moore & Edgar (1970), Clapham, Tutin and Warburg (1958) and Zotov (1943).

TABLE 1: VASCULAR PLANT FLORA OF SUGARLOAF BUSH

A western shady side of forest

B eastern sunny side of forest

* species adventive in the N.Z. flora

Trees	A	B
Aristotelia serrata (seedling only)	+	-
Griselinia littoralis (seedling only)	+	+
Nothofagus solandri var. *cliffortioides*	+	+
N. solandri var. *cliffortioides* x *N. fusca* (seedling, sapling, and probably adults)	+	-
Parasite		
Elytranthe tetrapetala	-	+
Vines		
Clematis australis	+	+
Muehlenbeckia complexa	+	+
Rubus cissoides	+	+
R. schmidelioides	+	+
Shrubs		
Aristotelia fruticosa	+	+
Coprosma linariifolia	+	+
C. microcarpa	+	+
C. sp. aff. *parviflora*	+	+
C. propinqua	+	+
C. rhamnoides	+	+
Corokia cotoneaster	-	+
Cyathodes fraseri (dwarf shrub)	-	+
C. juniperina	-	+
Discaria toumatou	-	+
Dracophyllum acerosum	+	-

Gaultheria antipoda	+	-
Hebe brachysiphon	+	+
H. salicifolia	+	+
Hymenanthera alpina	+	+
Leptospermum scoparium	-	+
Myrsine divaricata	-	+
Olearia arborescens	+	-
O. avicenniaefolia	-	+
Pittosporum divaricatum	+	+
Podocarpus nivalis	+	-
P. nivalis x *P. hallii*	+	-
**Rosa rubiginosa*	-	+

Herbs

Acaena anserinifolia	+	+
A. caesiiglauca	-	+
Anisotome filifolia	+	+
**Anthoxanthum odoratum*	+	-
Carex dissita var. *monticola*	-	+
Celmisia spectabilis	+	+
**Cerastium holosteoides*	+	+
**Cirsium arvense*	-	+
**C. lanceolatum*	+	+
**Crepis capillaris*	-	+
Epilobium spp.	+	+
Gnaphalium sp.	+	-
Gastrodia cunninghamii	+	-
Helichrysum bellidioides	+	+
H. filicaule	-	+
Hydrocotyle sp.	-	+
**Hypochoeris radicata*	-	+
**Mycelis muralis*	+	+
Poa imbecilla	+	+
Pratia angulata	+	-
Ranunculus hirtus	-	+
Senecio bellidioides	+	+
**S. sylvaticus*	-	+
**Trifolium repens*	-	+
Uncinia uncinata	+	+
Urtica incisa	+	+
**Verbascum thapsus*	-	+
Viola cunninghamii	-	+
Wahlenbergia albomarginata	+	-

Ferns

Asplenium flabellifolium	+	+
A. richardii	+	+
Blechnum penna-marina	+	+
B. "procerum"	+	+
Grammitis sp.	+	-
Histiopteris incisa	+	+
Hymenophyllum multifidum	+	-
H. peltatum	+	-
H. villosum	+	-
Hypolepis millefolium	-	+
Polystichum vestitum	+	+
Pteridium esculentum	-	+

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